

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 876 803 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
28.04.1999 Bulletin 1999/17

(51) Int. Cl.⁶: A61F 2/06

(43) Date of publication A2:
11.11.1998 Bulletin 1998/46

(21) Application number: 98201480.5

(22) Date of filing: 06.05.1998

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 08.05.1997 US 45991 P
08.05.1997 US 45992 P
08.05.1997 US 46003 P
08.05.1997 US 46866 P
29.01.1998 US 73309 P

(71) Applicant: C.R. BARD, INC.
Murray Hill New Jersey 07974 (US)

(72) Inventor:
The designation of the inventor has not yet been
filed

(74) Representative:
de Bruijn, Leendert C. et al
Nederlandsch Octrooibureau
P.O. Box 29720
2502 LS Den Haag (NL)

(54) TMR stent and delivery system

(57) A device and method for revascularizing myocardial tissue of the heart using stents are provided. Multiple stents are implanted into an area of hibernating myocardial tissue to permit blood to flow from the left ventricle directly into the tissue for revascularization. Various stent embodiments are disclosed that simultaneously pierce and penetrate the tissue during delivery and that are configured to resist migration out of the tis-

sue once implanted. Alternatively, the stents may be inserted into myocardial tissue over a piercing delivery device. The stents are preferably delivered through a steerable catheter percutaneously insertable into the left ventricle and configured to hold multiple stents. The stents are pushed from the catheter directly into the myocardium sequentially.

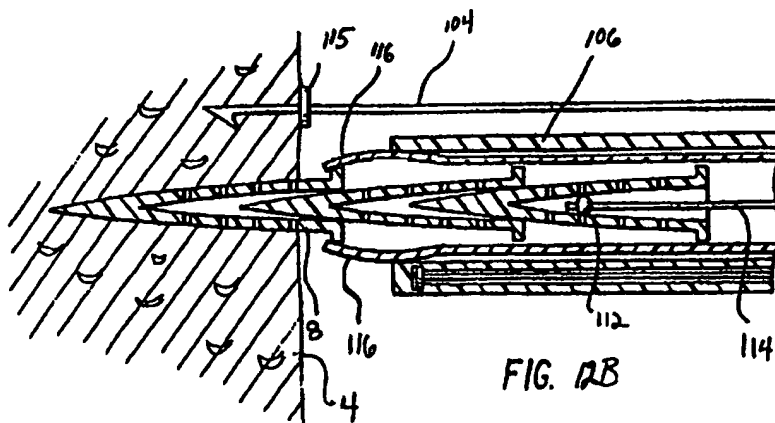


FIG. 12B

EP 0 876 803 A3



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 1480

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 296 19 029 U (KLETKE GEORG DR MED) 10 April 1997 * the whole document *	34	A61F2/06
A	---	1,5,12, 16	
A	WO 89 01798 A (ENGINEERS & DOCTORS AS ;JACOBSEN ERIK (DK); NIEBEN OLE GYRING (DK)) 9 March 1989 * the whole document *	1-3, 8-10,12, 14,18, 20,21, 28,29, 33,34	
A	WO 91 15254 A (ZIMMON DAVID S) 17 October 1991 * abstract; figures * * page 6, line 10 - page 7, line 5 *	1,2, 5-14,16, 17	
A	US 5 324 325 A (MOADDEB SHAHRAM) 28 June 1994 * abstract; figures *	1-3,5,8, 12,14,16	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	FR 1 514 319 A (ZACOUTO) 10 May 1968 * page 2, left-hand column, last paragraph - right-hand column, paragraph 2; figures *	1-3,5,7, 8,12,14, 16,17	A61F A61M A61B
A	US 5 287 861 A (WILK PETER J) 22 February 1994 * column 3, line 62 - column 4, line 30; figures * -/--	34,35	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 February 1999	Examiner Neumann, E
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/82 (P04C01)



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 20 1480

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 4 889 137 A (KOLOBOW THEODOR) 26 December 1989 * page 2, line 49 - page 3, line 5 *	18-21, 28,30,31	
P,X	WO 97 44071 A (SUDAI AMNON) 27 November 1997 * page 13, line 24 - page 14, line 8; figures *	34	
A	---	35	
A	FR 2 725 615 A (CAFFINIÈRE JEAN YVES DE) 19 April 1996 * figures 1,2 *	18,25	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18 February 1999	Examiner Neumann, E
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03.82 (P04C01)



European Patent
Office

Application Number

EP 98 20 1480

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



European Patent
Office

**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 98 20 1480

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-11,12-17

A self-piercing stent

2. Claims: 18-24,25-27

A nestable stent having a proximal and a distal end wherein the distal end is smaller than the proximal end so that another nestable stent can fit at least partially into the interior of the nestable stent; as well as a catheter to deliver at least one nestable stent.

3. Claims: 28-33

A Transmyocardial Revascularization stent defined by a helically wrapped ribbon and its distal end has a smaller diameter than its proximal end.

4. Claim : 34

A stent delivery device configured to move the stent through the catheter and simultaneously pierce and insert the stent into myocardial tissue.

5. Claim : 35

A catheter having two lumens which are offset from each other, a pull wire joined to the distal end of the catheter and extending to the proximal end arranged to cause bending movement of the distal end of the catheter and a piercing guidewire slidable in the second lumen.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 98 20 1480

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

18-02-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 29619029 U	10-04-1997	NONE	
WO 8901798 A	09-03-1989	DK 458787 A AU 2384288 A DE 3885763 D DE 3885763 T EP 0383780 A JP 3502894 T KR 9706098 B US 5098374 A	03-03-1989 31-03-1989 23-12-1993 10-03-1994 29-08-1990 04-07-1991 23-04-1997 24-03-1992
WO 9115254 A	17-10-1991	US 5052998 A AU 647119 B AU 7675191 A CA 2078211 A EP 0523176 A	01-10-1991 17-03-1994 30-10-1991 05-10-1991 20-01-1993
US 5324325 A	28-06-1994	NONE	
FR 1514319 A	10-05-1968	NONE	
US 5287861 A	22-02-1994	US 5409019 A US 5429144 A	25-04-1995 04-07-1995
US 4889137 A	26-12-1989	AU 3574689 A EP 0481977 A IL 90208 A JP 3504090 T WO 8910769 A	29-11-1989 29-04-1992 27-02-1994 12-09-1991 16-11-1989
WO 9744071 A	27-11-1997	AU 2711897 A	09-12-1997
FR 2725615 A	19-04-1996	NONE	

EPO FORM P0489

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82